CLAIMS

What is claimed is:

1. A powder metal mixture comprising a ferrous metal powder and a modified lubricant consisting essentially of (i) a lubricant powder and (ii) starch particles having an average equivalent diameter less than 150 μm, the modified lubricant being present in an amount less than 2% by weight of the composition, the mixture having (i) a Hall apparent density numerically no smaller than 10% less than that obtained for the same powder metal mixture made with a conventional lubricant without the starch particles, and (ii) a Hall flow rate which is in the range from about 25 - 40 sec/ 50 g of mixture.

2. The mixture of claim 1 wherein the starch particles have an average equivalent diameter less than 50 μm, and the lubricant powder is selected from the group consisting of fatty acid monoamides, fatty acid bisamides, metal soaps and polyolefin waxes.

3. The mixture of claim 1 wherein about 90% by wt of the starch particles have an avg. equiv. dia. in the range from 5 to 50 μm; from 5 to 40 % by wt have an avg. equiv. dia. in the range from 2 to 20 μm; and the satrch has a Hall apparent density in the range from 2.8 to 3.2 g/cc, and the Hall flow rate of the mixture is in the range from about 25 - 35 sec/ 50 g of mixture.

4. The mixture of claim 1 including fragmented cellulose fibers having an average length less than 150 μm and a diameter in the range from about 1μ to 20μ, present in an amount no more than the starch particles.

5. The mixture of claim 4 wherein the modified lubricant is preferably in the range from 0.25% to 1% by weight and the weight ratio of lubricant/starch in

starchlube, and, of lubricant/(starch + cellulose fragments) if present, is in the range from about 1 : 2 to 10 : 1, preferably from 1 : 1 to 4 :1.

6. The modified lubricant of claim 1 wherein the starch particles are irradiated with from 10 – 30 MegaRads of gamma radiation.

7. The modified lubricant of claim 6 including fragmented cellulose fibers having an average length less than 150 μm and a diameter in the range from about 1μ to 20μ, present in an amount no more than the starch particles, and the starch particles are irradiated with from about 15 MegaRads of gamma radiation.

8. The modified lubricant of claim 7 wherein the fragmented cellulose fibers have been exposed to electron beam radiation to receive a dosage in the range from about 30 to 100 MegaRads.

9. In a powder ferrous metal mixture including a lubricant, the mixture having a Hall flow rate in the range from about 25 – 40 sec/ 50 g of mixture, the improvement comprising a modified lubricant consisting essentially of (i) a lubricant powder and (ii) starch particles having an average equivalent diameter less than 150 μm present in an amount from about 0.25% to less than 0.75% by weight of the mixture, and (iii) fragmented cellulose fibers having an average length less than 150 μm and a diameter in the range from about 1μ to 20μ, present in an amount from 0% to less than 0.75% by weight of the mixture, but no more than the starch present, the modified lubricant being present in an amount less than 1.5% by weight of the composition, the mixture having (i) a Hall apparent density numerically no smaller than 10% less than that obtained for the same powder metal mixture made with a conventional lubricant without the starch particles, the weight ratio of lubricant/starch in starchlube, and, of lubricant/(starch + cellulose fragments), if present, is in the range from about 1 : 2 to 10 : 1, preferably from 1 : 1 to 4 :1.

10. The mixture of claim 9 wherein the starch particles are irradiated with from 10 – 30 MegaRads of gamma radiation, and the fragmented cellulose fibers have been exposed to electron beam radiation to receive a dosage in the range from about 30 to 100 MegaRads, and the Hall flow rate is in the range from about 25 – 35 sec/ 50 g of mixture.

11. A method for making a homogeneous ferrous powder metal mixture comprising,

combining metal particles having an average particle diameter smaller than about 150 μm with a modified lubricant consisting essentially of (i) a lubricant powder and (ii) starch particles having an average equivalent diameter less than 150 μm, the modified lubricant being present in an amount less than 2% by weight of the composition, the mixture having (i) a Hall apparent density numerically no smaller than 10% less than that obtained for the same powder metal mixture made with a conventional lubricant without the starch particles, and (ii) a Hall flow rate which is in the range from about 25 – 40 sec/ 50 g of mixture, and,

compacting the mixture in a die to form a compacted green article.

12. The method of claim 11 wherein the Hall apparent density is greater than that obtained for the same powder metal mixture made with a conventional lubricant without the starch particles, and the Hall flow rate is in the range from about 25 – 35 sec/ 50 g of mixture.

13. A modified lubricant adapted for use in a powder metal article, the modified lubricant consisting essentially of a lubricant selected from the group consisting of an inorganic compound, an organometal compound, and a wax, the lubricant having an average particle diameter smaller than 50 μm, in combination with starch particles, wherein about 90% by wt of the starch particles have an avg. equiv. dia. in the range from 5 to 50 μm; from 5 to 40 % by wt have an avg. equiv. dia. in the range from 2 to

20 μm; and the starch has a Hall apparent density in the range from 2.8 to 3.2 g/cc.

14. The modified lubricant of claim 13 wherein the starch particles are irradiated with from 10 – 30 MegaRads of gamma radiation.

15. The modified lubricant of claim 14 including fragmented cellulose fibers having an average length less than 150 μm and a diameter in the range from about 1μ to 20μ, present in an amount no more than the starch particles.

16. The modified lubricant of claim 15 wherein the fragmented cellulose fibers have been exposed to electron beam radiation to receive a dosage in the range from about 30 to 100 MegaRads.